CLAIMS

1. A method for preserving a biomaterial, the method comprising:

a) exposing a biomaterial having a membrane and at least one transporter molecule to a preservation agent, the transporter molecule being effective to transport the preservation agent across the membrane to load the biomaterial with the preservation agent to a desire concentration sufficient for preserving the biomaterial;

b) preparing the preservation agent loaded biomaterial for storage in a preserved state.

2. The method of claim 1, wherein the step of preparing the preservation agent loaded biomaterial for storage in a preserved state includes at least one selected from the group consisting of freezing, drying, and freeze-drying the biomaterial.

3. The method of claim 1, wherein the step of preparing the preservation agent loaded biomaterial for storage in a preserved state includes drying the biomaterial.

4. The method of claim 3, wherein the drying is accomplished by at least one selected from the group consisting of air drying, vacuum drying, and desiccation.

5. The method of claim 1, further comprising:

c) storing the preservation agent loaded biomaterial.

6. The method of claim 5, wherein the preservation agent loaded biomaterial is stored in a frozen state.

7. The method of claim 5, wherein the preservation agent loaded biomaterial is stored in a dry state.

8. The method of claim 5, further comprising:

d) recovering at least a portion of the preservation agent loaded biomaterial in a viable state.

9. The method of claim 8, wherein the step of recovering includes removing the preservation agent from the biomaterial.

10. The method of claim 1, wherein the biomaterial is selected from the group consisting of organs, tissues, cells, stem cells, cell-lines, bone marrow, embryos, platelets, fibroblasts, lymphocytes, hepatocytes, osteoblasts, spermatozoa, granulocytes, red blood cells, dendritic cells, oocytes, and plant cells.

11. The method of claim 1, wherein the biomaterial includes mammalian cells.

12. The method of claim 11, wherein the biomaterial includes hepatocytes.

13. The method of claim 1, wherein the transporter molecule is a selected from the group consisting of a glucose transporter protein (GLUT), a sucrose transporter protein, a mannose transporter protein, a galactose transporter protein, and a hexose transporter protein.

14. The method of claim 1, wherein the transporter molecule is a glucose transporter protein (GLUT).

15. The method of claim 1, wherein the non-metabolizable preservation agent is a non-metabolizable carbohydrate.

16. The method of claim 15, wherein the non-metabolizable carbohydrate is selected from the group consisting of 3-O-methyl-glucose (3OMG), 2-deoxy-glucose (2DG), 6-deoxy-glucose (6DG), methyl α-D-glucoside, methyl β-D-glucoside, 1,6-anhydro-β-D-glucose, and 1,5-anhydro-D-glucitol.

17. The method of claim 15, wherein the non-metabolizable preservation agent is 3-O-methyl-glucose (3OMG).

18. The method of claim 15, wherein the non-metabolizable preservation agent is 2-deoxy-glucose (2DG).

19. A method for preserving one or more mammalian cells, the method comprising:

a) exposing one or more mammalian cells having a membrane and at least one transporter protein to a non-metabolizable preservation agent, the transporter protein being effective to transport the non-metabolizable preservation agent across the membrane to load the mammalian cells with the non-metabolizable preservation agent to a desired intracellular concentration sufficient for preserving the mammalian cells;

b) preparing the preservation agent loaded mammalian cells for storage in a preserved state;

c) storing the preservation agent loaded mammalian cells in a preserved state; and

d) recovering at least a portion of the preservation agent loaded mammalian cells to a viable state.

20. The method of claim 19, wherein the mammalian cells comprise nucleated mammalian cells.

21. The method of claim 19, wherein the mammalian cells include at least one selected from the group consisting of organ cells, tissue cells, stem cells, cell-lines, bone marrow cells, embryo cells, platelets, fibroblasts, lymphocytes, hepatocytes, osteoblasts, granulocytes, red blood cells, and dendritic cells.

22. The method of claim 19, wherein the mammalian cells comprise hepatocytes.

23. The method of claim 19, wherein the step of preparing the preservation agent loaded mammalian cells for storage in a preserved state includes at least one selected from the group consisting of freezing, drying, and freeze-drying.

24. The method of claim 19, wherein the step of preparing the preservation agent loaded mammalian cells for storage in a preserved state includes drying.

25. The method of claim 24, wherein the drying is accomplished by at least one selected from the group consisting of air drying, vacuum drying, and desiccation.

26. The method of claim 19, wherein the transporter protein is a selected from the group consisting of a glucose transporter protein (GLUT), a sucrose transporter protein, a mannose transporter protein, a galactose transporter protein, and a hexose transporter protein.

27. The method of claim 19, wherein the transporter protein is a glucose transporter protein (GLUT).

28. The method of claim 19, wherein the non-metabolizable preservation agent is a non-metabolizable carbohydrate.

29. The method of claim 28, wherein the non-metabolizable carbohydrate is selected from the group consisting of 3-O-methyl-glucose (3OMG), 2-deoxy-glucose (2DG), 6-deoxy-glucose (6DG), methyl α-D-glucoside, methyl β-D-glucoside, 1,6-anhydro-β-D-glucose, and 1,5-anhydro-D-glucitol.

30. The method of claim 28, wherein the non-metabolizable preservation agent is 3-O-methyl-glucose (3OMG).

31. The method of claim 28, wherein the non-metabolizable preservation agent is 2-deoxy-glucose (2DG).

32. The method of claim 19, wherein the desired intracellular concentration of non-metabolizable preservation agent is less than or equal to about 1.0 M.

33. The method of claim 19, wherein the desired intracellular concentration of non-metabolizable preservation agent is less than or equal to about 0.4 M.

34. The method of claim 19, wherein the desired intracellular concentration of non-metabolizable preservation agent is less than or equal to about 0.2 M.

35. The method of claim 19, wherein the mammalian cells are preserved in a frozen state.

36. The method of claim 19, wherein the mammalian cells are preserved in a dry state.

37. A method for preserving one or more nucleated mammalian cells, the method comprising:

a) exposing one or more nucleated mammalian cells having a membrane and at least one transporter protein to a preservation agent comprising a non-metabolizable carbohydrate, the transporter protein being effective to transport the non-metabolizable carbohydrate across the membrane to load the nucleated mammalian cells with the non-metabolizable carbohydrate to a desired intracellular concentration sufficient for preserving the mammalian cells;

b) preparing the preservation agent loaded nucleated mammalian cells for storage in a preserved state by a method selected from the group consisting of freezing, drying, and freeze-drying;

c) storing the preservation agent loaded nucleated mammalian cells in a preserved state, the preservation agent loaded nucleated mammalian cells being stored in a state selected from the group consisting of a dry state and a frozen state; and

d) recovering at least a portion of the preservation agent loaded mammalian cells to a viable state.

38. The method of claim 37, wherein the transporter protein is a selected from the group consisting of a glucose transporter protein (GLUT), a sucrose transporter protein, a mannose transporter protein, a galactose transporter protein, and a hexose transporter protein.

39. The method of claim 37, wherein the transporter protein is a glucose transporter protein (GLUT).

40. The method of claim 39, wherein the non-metabolizable carbohydrate is selected from the group consisting of 3-O-methyl-glucose (3OMG), 2-deoxy-glucose (2DG), 6-deoxy-glucose (6DG), methyl α-D-glucoside, methyl β-D-glucoside, 1,6-anhydro-β-D-glucose, and 1,5-anhydro-D-glucitol.

41. The method of claim 39, wherein the non-metabolizable carbohydrate is 3-O-methyl-glucose (3OMG).

42. The method of claim 39, wherein the non-metabolizable carbohydrate is 2-deoxy-glucose (2DG).

43. The method of claim 37, wherein the desired intracellular concentration of non-metabolizable carbohydrate is less than or equal to about 1.0 M.

44. The method of claim 37, wherein the desired intracellular concentration of non-metabolizable carbohydrate is less than or equal to about 0.4 M.

45. The method of claim 37, wherein the desired intracellular concentration of non-metabolizable carbohydrate is less than or equal to about 0.2 M.

46. A mammalian cell prepared for preservation comprising:

a cell membrane;

a non-metabolizable carbohydrate loaded to a desired intracellular concentration sufficient to preserve the cell; and

a transporter protein effective to transport the non-metabolizable carbohydrate across the membrane to load the mammalian cell with the non-metabolizable carbohydrate to the desired intracellular concentration;

wherein the mammalian cell is in a state selected from the group consisting of frozen and dry.

47. The cell of claim 46, wherein the transporter protein is a selected from the group consisting of a glucose transporter protein (GLUT), a sucrose transporter protein, a mannose transporter protein, a galactose transporter protein, and a hexose transporter protein.

48. The cell of claim 46, wherein the transporter protein is a glucose transporter protein (GLUT).

49. The cell of claim 48, wherein the non-metabolizable carbohydrate is selected from the group consisting of 3-O-methyl-glucose (3OMG), 2-deoxy-glucose (2DG), 6-deoxy-glucose (6DG), methyl α-D-glucoside, methyl β-D-glucoside, 1,6-anhydro-β-D-glucose, and 1,5-anhydro-D-glucitol.

50. The cell of claim 48, wherein the non-metabolizable carbohydrate is 3-O-methyl-glucose (3OMG).

51. The cell of claim 48, wherein the non-metabolizable carbohydrate is 2-deoxy-glucose (2DG).

52. The cell of claim 46, wherein the desired intracellular concentration of non-metabolizable carbohydrate is less than or equal to about 1.0 M.

53. The cell of claim 46, wherein the desired intracellular concentration of non-metabolizable carbohydrate is less than or equal to about 0.4 M.

54. The cell of claim 46, wherein the desired intracellular concentration of non-metabolizable carbohydrate is less than or equal to about 0.2 M.

55. The cell of claim 46, wherein the mammalian cell is a nucleated mammalian cell.

56. The cell of claim 46, wherein the mammalian cell is selected from the group consisting of organ cells, tissue cells, stem cells, cell-lines, bone marrow cells, embryo cells, platelets, fibroblasts, lymphocytes, hepatocytes, osteoblasts, granulocytes, red blood cells, and dendritic cells.

57. The cell of claim 46, wherein the mammalian cell is a hepatocyte.